CENTER FOR HEALTH ECONOMICS RESEARCH, INC.

1835 K Street, N.W., Suite 305
Washington, DC 20006
(202) 682-5883
(202) 682-0452 FAX

IMPACT OF THE MEDICARE FEE SCHEDULE ON TEACHING PHYSICIANS

Final Report

Prepared for:

Health Care Financing Administration

Submitted by:

Janet B. Mitchell, Ph.D.

Center for Health Economics Research

February 12, 1997
June 5, 1997 (revised)

This report was funded by the Health Care Financing Administration under HCFA Cooperative Agreement No. 17-C-90015-1, William Buczko, Project Officer. The views and opinions expressed in this report are those of the authors and no endorsement by HCFA or DHHS should be inferred or implied.

TABLE OF CONTENTS

TABLE OF TABLES

PAGE

TABLE OF TABLES
(continued)

PAGE

1.0 EXECUTIVE SUMMARY

1.1 Statement of the Problem

1.1.1 Anticipated Physician Responses to the Medicare Fee Schedule

Beginning in January 1992, Medicare introduced a fundamental change in the methods used to reimburse physician services. This new Medicare Fee Schedule (MFS) was based on the Resource-Based Relative Value Scale (RBRVS) and dramatically altered the relative prices paid to physicians. Relative payment levels were greatly increased for visits, and reduced for most types of diagnostic tests and surgical procedures. In addition, the MFS adjusted payments by the Geographic Practice Cost Index (GPCI) in order to take into account the actual costs of physician practice in different parts of the country. This adjustment raised relative payment levels in rural areas and lowered them in large urban areas.

Prior to implementation of the MFS, several studies were conducted to examine potential redistributive effects on physicians (Lee *et al.*, 1989; Levy *et al.*, 1990). These simulations confirmed that, given existing practice patterns, thoracic surgeons, ophthalmologists, and radiologists would lose money, while family practitioners and internists would reap higher reimbursements. Similarly, physicians practicing in very large metropolitan areas would fare less well, compared with those in rural areas. No studies examined the potential impact of the MFS on teaching physicians, however, and anecdotal evidence from academic practices suggested that these physicians would be particularly hard hit for four reasons:

1. **service mix.** Teaching physicians perform relatively more high-technology procedures and less primary care. The change in relative prices associated with the RBRVS portion of the MFS could result in disproportionate net losses for many academic practices.

2. **geographic location.** Teaching hospitals generally, and medical schools in particular, tend to be located in large urban areas. Thus, the GPCI portion of the MFS could lower payments relatively more for teaching physicians relative to non-teaching physicians.

3. **historical payments.** Customary charges for teaching physicians may be higher than the area-wide historical payments calculated for fee schedule transition.

4. **participation status.** An unknown number of academic medical practices had not signed Medicare participation agreements. The balance billing limits that accompanied the MFS thus could further constrain revenues for some teaching physicians.

Whether teaching physicians are disproportionately affected by the MFS will depend not only on relative price changes but also on any volume responses. Policymakers traditionally have feared that physicians will respond to fee reductions by increasing the number of services they provide (e.g., the controversial "volume offset" assumption). It is possible, however, that physicians will respond by providing fewer services to their Medicare patients.

Work by McGuire and Pauly (1991) has shown that physician responses to payment reductions will depend on the relative magnitude of income and substitution effects. On the one hand, a Medicare fee cut reduces income, leading physicians to provide more of all services (not just the service whose price was cut); this is the "income effect" of a price change. On the other hand, after the fee reduction, there is less return to the physician from providing that service to Medicare patients relative to other patients, encouraging the physician to provide less to Medicare patients and more in other, better-paying markets (the "substitution effect"). Income effects are hypothesized to be stronger for those physicians with relatively larger shares of their practice devoted to the services whose fees were cut and with relatively larger Medicare shares. Substitution effects are hypothesized to be stronger when margins (the fee for the service minus the cost of providing it) are relatively greater in the non-Medicare market and when physicians' Medicare market shares are relatively smaller.

Mitchell and Cromwell (1995) found considerable support for this model in their study of the OBRA-87 payment reductions. Despite reduced fees, Medicare utilization rates for bypass surgery, joint replacement, and cataract extraction increased; these are procedures which represent relatively large practice shares for thoracic surgeons, orthopedic surgeons, and ophthalmologists, respectively. By contrast, internists and other medical specialists are not

particularly dependent on any of the endoscopic procedures whose fees were cut (like bronchoscopy and upper GI endoscopy). Utilization rates for these procedures either fell or remained constant.

Relatively little is known about physician responses to Medicare fee *increases*, as Medicare's historic experience has been with reductions in payment levels (e.g., the Medicare fee freeze, the OBRA-87 overpriced procedure reductions, etc.). Policymakers certainly hoped, however, that higher visit reimbursement levels under the MFS would encourage physicians to provide more patient contacts.

1.1.2 The Unique Case of Teaching Physicians

The purpose of this study is to evaluate whether the MFS has had a disproportionate impact on teaching physicians, compared to non-teaching physicians and if so, in what way. Ideally, we would model physician behavioral responses to price changes, and test differential responses by teaching and non-teaching physicians. However, the availability of residents to substitute for teaching physicians, and the propensity of many teaching physicians to *not* always bill for services they provide, make it impossible to disentangle whether any change in volume represents a *true* change in the amount of care provided or simply a change in *billing patterns*. We elaborate on this more below.

Unlike other physicians, teaching physicians need not actually perform a service in order to submit a Part B bill. They may bill for those services provided by residents but which they (the teaching physicians) directly supervise.[1] Anecdotal evidence suggests that there is considerable variability in how the regulations are interpreted regarding when fee-for-service billing is appropriate. In a series of case studies conducted in 1993, we found that, while teaching physicians reported increased pressure (from department chairs and faculty practice plans) to bill fee-for-service, many physicians found it administratively onerous to do so (Burge, Mitchell, and Katz, 1994). Some physicians reported that they chose academic practice in the first place to avoid such responsibilities.

---

[1] From 1969 until 1996, the guidelines for appropriate billing by teaching physicians were outlined in Intermediary Letter No. 372 (IL-372). Historically, these guidelines have been difficult to operationalize and even more difficult to monitor. HCFA issued new regulations on July 1, 1996, but considerable ambiguity remains.

Analysis of claims data also suggests that fee-for-service billing may vary by teaching intensity. Mitchell and Ellis (1992) found that, after controlling for casemix, Part B revenues per admission were significantly lower in major teaching hospitals (i.e., those hospitals with 25 residents or more per 100 beds), compared with revenues in *either* minor or non-teaching institutions. Since it is implausible that care in major teaching hospitals is less service-intensive, we suspect that many services in these facilities were provided "free" (i.e., not billed) by residents.

Using 1991 data for our sample of hospitals, we examined patterns of service use for selected DRGs (Mitchell, Burge, and McPartlin, 1995). We found that, after adjusting for length of stay, physicians in teaching hospitals billed for significantly fewer routine hospital visits. Based on the Part B claims, medically treated AMI patients in non-teaching hospitals, for example, received a routine hospital visit daily. By contrast, the rate was only 0.79 visits per day for similar patients treated in academic medical centers. It seems reasonable to assume that such very sick patients would be visited at least daily; hence, it is most likely that the "missing visits" were provided by residents and, for whatever reason, not billed by the supervising physicians.

Given this inability to distinguish changes in true volume from changes in billing patterns, and the considerable controversy that inevitably surrounds any test of physician volume responses, we chose instead to calculate the net effects of MFS price changes, and any *observed* quantity changes, on inpatient physician revenues. This still allows us to answer the research questions of principal interest: (1) Were teaching physicians adversely affected by MFS payment changes, relative to non-teaching physicians? and (2) Were physicians in major teaching hospitals, especially academic medical centers, affected more than those in minor teaching hospitals?

1.2 Conceptual Framework

1.2.1 Decomposition of Part B Revenues Per Admission

The primary research question is to compare the change in Part B revenues per admission between teaching and non-teaching physicians. To do this, we have developed a methodological approach that allows us to decompose those revenues as follows:

$$REV / ADM = REV / S \bullet S / RVU \bullet RVU / ADM$$

where REV/ADM = Part B revenues per admission, REV/S = revenues per service (e.g., per visit, per surgical operation, etc.), S/RVU = the inverse of RVUs per service (or procedure intensity within service), and RVU/ADM = RVUs per admission. This decomposition suggests two price variants, one per service and a second per RVU, e.g., R/RVU.

Revenues may change over time, due to changes in intensity (RVU/ADM), changes in the price per service (REV/S), or changes in coding or practice changes that alter the service definition (S/RVU). CABG surgery provides a good example of the latter. Historically, physicians billed one of six procedure codes, depending on the number of grafts they inserted. Beginning in 1993, however, an expanded list of 13 codes were available, depending on not only the number, but the type (venous vs. arterial), of grafts. Depending on the combination of grafts used, surgeons might bill two codes, rather than one. In addition, a new code was added that provided additional RVUs (and hence payments) for patients with a prior history of bypass surgery. As a result of these coding changes (and the secular trend towards such re-operations), the price of CABG surgery (REV/S) may change solely due to a change in the number of RVUs associated with the procedure (S/RVU). At the same time, we also would expect a change in REV/S as a result of the MFS.

The percent change in Part B revenues per admission can be decomposed (approximately) as:

$$\%\Delta REV / ADM = (\%\Delta REV / RVU) \bullet \frac{RVU'}{RVU_0} + (\%\Delta RVU / ADM) \bullet \frac{REV'}{REV_0}$$

where $\%\Delta$ = percent change, RVU'/RVU_0 = ratio of average RVUs per admission over the period to base period RVUs, and R'/R_0 = a similar ratio of Part B allowed charges per RVU. The pure price percent change can be further decomposed as:

$$\%\Delta REV / RVU = (\%\Delta REV / S) \bullet \frac{S'}{S_0} + (\%\Delta S / RVU) \bullet \frac{RS'}{RS_0}$$

where S'/S_0 = ratio of average to base period services per RVU, and RS'/RS_0 = a similar ratio of average to base period revenues per service.

Weighting percent changes by average to base period ratios reflects the correlation that may exist between price and quantity. Both may be falling over time, in which case the simple sum of their (negative) percent changes would overstate the total percent change in revenues. Ignoring this interaction would overstate the total percent change if both prices and quantities were growing.

1.2.2 Hypothesized Impacts on Teaching Physicians

How do we expect these different components of revenues to have changed under the MFS for teaching hospitals? We know that the relative prices for individual services (REV/S) changed dramatically as the result of the MFS, with prices increasing for evaluation and management services and decreasing for surgical and diagnostic procedures. Given the relatively greater emphasis on high-tech tests and procedures in teaching hospitals, we hypothesize that the *net* effect of this price change was negative and larger in absolute magnitude, compared with non-teaching hospitals. Procedure intensity within service

(RVU/S, or the inverse of S/RVU), on the other hand, is hypothesized to increase over this time period. As easier cases continue to be shifted to the outpatient setting, those patients remaining in the hospital will become sicker on average, requiring a more intensive mix of services. They may receive a more complex variant of a given surgical procedure, for example, or longer hospital visits or consultations. Given the relatively more complicated casemix treated in teaching hospitals, RVU/S may increase comparatively more in these institutions.

RVUs per admission may increase over time, because either a larger number of services, or a more complex mix of services, are being provided during the stay. To the extent that the inpatient casemix becomes sicker over time, RVUs per admission are hypothesized to increase over time, especially in teaching hospitals. At the same time, however, there is a continuing trend toward shifting some services to the pre and post-hospitalization time periods. Our measure of *inpatient* RVUs will not capture these services, and RVUs per admission could appear to fall over time, especially for diagnostic tests. There is no evidence to suggest that teaching physicians are any more likely to shift services outside the inpatient stay than are non-teaching physicians, however.

Finally, RVUs per admission may change over time because of a change in billing. Teaching physicians in our case studies reported increased pressure to bill for services they provided. Since we expect this trend to continue, we would hypothesize an increase in RVUs per admission in teaching hospitals, relative to non-teaching hospitals. This increase may be particularly marked for hospital visits whose claims appear to have been under-represented in major teaching hospitals.

In sum, we expect a relatively larger reduction in REV/S for teaching physicians, but at the same time, a relatively larger increase in S/RVU and RVU/ADM, compared with non-teaching physicians. The *net* effect of these various factors on total inpatient revenues per admission is impossible to determine a priori. For this, we turn to the empirical data.

1.3 Methods

1.3.1 Sample Design and Data Sources

A stratified random sample of hospitals was selected from the 1991 Provider of Service file, with the strata defined by teaching status: (1) academic medical centers; (2) other COTH hospitals; (3) other teaching hospitals; and (4) non-teaching hospitals. A total of 720 hospitals initially were selected. Due to closure or merger over the 1991-1993 study period, 12 hospitals had to be dropped. An additional seven teaching hospitals were dropped, because their physicians had exercised the cost-election option; in these cases, physicians agree not to bill fee-for-service, and instead their institutions receive a cost-based payment for their services. The final sample consisted of 701 hospitals. All observations were weighted by the hospital's sampling weight (based on the probability of its selection), as well as by its total number of Medicare admissions.

All discharges from sample hospitals from 1991 to 1993 were identified from their MedPAR records. Using the Health Insurance Claim (HIC) numbers on these records, we then extracted all Part B claims associated with those discharges (using admission and discharge dates).

1.3.2 Variable Construction

Four key analytic variables were constructed for each hospital-year: Part B revenues per admission, RVUs per admission, a price per service index, and a price per RVU. Each of these variables was created for overall inpatient services, and for five separate categories of services:

1. evaluation and management (E&M) services;
2. high-tech surgical procedures, defined as those with RVUs of 40 or more;
3. general (all other) surgical procedures;
4. high-tech tests, defined as those with RVUs of 1.3 or more; and
5. routine (all other) tests.

Part B revenues are simply the sum of all Part B allowed charges for inpatient services. RVUs were merged onto each claim by CPT code and modifier, using constant (1993) RVUs for each year.

The price per service index was constructed for a "market-basket" of high-volume procedures. The average allowed charge for each procedure was calculated for each hospital-year. Fees for market-basket procedures were then combined into a weighted average fee, using hospital-specific base-period weights. An index was constructed by dividing through the weighted average fee for each year by the corresponding 1991 value.

The resulting index represents the change in Medicare payments that would have been received as a result of the MFS, *assuming no change in the mix of services*. It is possible, however, that service mix could change due to changes in technology or casemix or in response to the MFS itself. For this reason, we also calculated a price per RVU, by dividing each hospital's revenues by its RVUs. Since this measure was based on the current year's mix of services, it may provide a more accurate representation of the price actually paid.

1.4 Results

1.4.1 Overall Changes in Revenues, RVUs, and Prices

Table 1-1 displays the time trend in revenues per admission, RVUs per admission, the price per service index, and the average price per RVU. These numbers are based on those services whose payments are based on the RBRVS only. Thus, anesthesia and ECGs are excluded.[2] Total inpatient revenues declined by about one-fifth over the three year period in all types of hospitals. Physicians in other COTH and other teaching hospitals enjoyed significantly smaller revenue reductions, compared with their non-teaching colleagues. There were no significant differences between academic medical center physicians and those in non-teaching hospitals.

Surprisingly, physician service intensity (RVUs per admission) declined over the study period, falling 12-13 percent in all types of hospitals. We had hypothesized that financial pressures (including the MFS) would encourage physicians in teaching hospitals to bill for services they provided (but which historically may have been under-reported). There is no

[2] The interested reader can find data on these services in Table 3-1, however.

TABLE 1-1

CHANGES IN TOTAL REVENUES, RVUs, AND PRICES PER ADMISSION, 1991 - 1993

	1991	1992	1993	Percent Change
Allowed Charges/Admission				
Academic Medical Centers	$1,614.39	$1,383.98	$1,295.14	-19.8 %**
Other COTH Hospitals	1,574.21	1,349.02	1,285.04	-18.4 **[a]
Other Teaching Hospitals	1,359.88	1,177.62	1,097.40	-19.3 **[a]
Non-Teaching Hospitals	1,100.55	916.11	858.85	-22.0 **
RVUs/Admission				
Academic Medical Centers	40.73	37.92	36.37	-10.7 **
Other COTH Hospitals	40.71	37.18	36.20	-11.1 **
Other Teaching Hospitals	38.22	35.41	33.61	-12.1 **
Non-Teaching Hospitals	30.57	28.31	26.88	-12.1 **
Average Price Per Service Index				
Academic Medical Centers	1.00	0.90	0.85	-15.3 **[a]
Other COTH Hospitals	1.00	0.92	0.89	-10.7 **[a]
Other Teaching Hospitals	1.00	0.94	0.92	-7.9 **[a]
Non-Teaching Hospitals	1.00	0.95	0.97	-3.3 **
Average Price Per RVU				
Academic Medical Centers	$40.03	$36.66	$35.66	-10.9 %**
Other COTH Hospitals	39.48	36.75	35.98	-8.9 **
Other Teaching Hospitals	36.67	33.92	33.13	-9.7 **[b]
Non-Teaching Hospitals	36.25	32.53	32.24	-11.1 **

** Percent change from 1991 to 1993 significant at the 0.01 level.

* Percent change from 1991 to 1993 significant at the 0.05 level.

[a] Significantly different from non-teaching hospitals at the 0.01 level.

[b] Significantly different from non-teaching hospitals at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

reason to expect the opposite to have occurred; thus, it appears that the true number of inpatient services fell from 1991 to 1993 in teaching, as well as non-teaching, hospitals.

As expected, given their relatively greater emphasis on high-tech tests and procedures, teaching physicians in general, and those in academic medical centers in particular, received significantly larger price reductions. While physicians in non-teaching hospitals experienced only a 3 percent reduction in the average price per service, based on their 1991 service mix, those in academic medical centers received a price reduction five times greater (15%).

By contrast, the average price per RVU showed considerably less variation across hospital types, declining between 9 and 11 percent. Thus, the *effective* price change was considerably lower than expected for teaching hospitals (e.g., 11% vs. 15% in academic medical centers), and higher than expected for non-teaching hospitals (11% vs. 3%). This suggests that physicians modified the mix of services they provided (and billed for) over this time period.

1.4.2 Changes by Service Category

Table 1-2 displays the percent change in revenues per admission by the five service categories we examined. Inpatient revenues fell in *all* groups of services, even evaluation and management (although the absolute magnitude of the decline was relatively small and not always significant). We found that, as with total revenues, reductions in both prices and RVUs generally contributed to these declines.

- Declines in revenues for **E&M services** would appear surprising, given the considerable increase in MFS payments for these services. Revenues and RVUs did increase for hospital visits and consultations, but declined precipitously for critical care visits (the latter as the result of coding changes associated with MFS implementation), especially in non-teaching hospitals.

- There were few changes in the quantity of **high-tech surgery** provided per admission. The revenue decline can be attributed largely to falling prices under the MFS.

- While average prices fell for **general surgical procedures**, RVUs also generally declined, especially among non-teaching hospitals. The reduction in RVUs appears to be due to the shift of some procedures to outpatient settings, as well as a secular decline in performance of TURPs.

TABLE 1-2

PERCENT CHANGES IN REVENUES PER ADMISSION BY SERVICE CATEGORY, 1991 - 1993

Service Categories	Academic Medical Centers	Other COTH Hospitals	Other Teaching Hospitals	Non-Teaching Hospitals
Evaluation and Management	-2.4 %*	-1.1	-2.8	-6.4 *
High-Tech Surgery	-20.2 **	-19.3 **	-15.7 **	-16.0 **
General Surgery	-17.1 **	-19.6 **	-20.1 **	-22.8 **
High-Tech Tests	-22.5 **	-22.0 **	-23.5 **	-22.6 **
Routine Tests	-22.8 **	-16.0 **	-17.2 *	-22.5 **
All Services	***-19.8 *****	***-18.4 *****	***-19.3 *****	***-22.0 *****

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

- Revenue reductions for **high-tech tests** were driven largely by cardiac catheterization which dominated this service category. While the average price per service fell 20 percent, RVUs per admission fell even more: 50 percent. In part, this reflects a shift of uncomplicated cardiac cath procedures to the outpatient department. It is also due to a billing change; physicians greatly increased the frequency with which they coded bills to indicate interpretation and report only when reporting inpatient cardiac cath procedures. This effectively lowered the number of RVUs billed per procedure.

- Both price and quantity reductions contributed to the revenue declines for **routine tests**. These tests account for a relatively small share of total inpatient revenues, however.

1.4.3 Conclusions

We found no evidence that teaching physicians have been adversely impacted by the MFS. Inpatient revenues per admission fell by the same percentage amount in all types of hospitals. Revenues fell, both because of a reduction in prices and because of a reduction in the quantity of services per admission. The contributions of price per RVU and RVUs per admission to the declines in revenue, furthermore, were strikingly similar across the four hospital groups. The decline in inpatient physician service intensity was surprising, given the historical trends towards growing intensity (Miller and Welch, 1993; Mitchell, 1993). A combination of factors appears responsible, including an increased shift of diagnostic tests to outpatient settings, a secular decline in some surgical procedures, and coding changes that accompanied MFS implementation.

While our analysis confirms that teaching physicians would have experienced a disproportionately large reduction in their average price per service (given their high-tech service mix), their *effective* price reduction proved to be considerably smaller. Teaching physicians appear to have altered the mix of services they provided (and/or billed for), for example, by substituting less RVU-intensive visits for high-tech diagnostic tests. As a result, the actual decline in price per RVU proved to be remarkably similar for teaching and non-teaching physicians.

1.5 Overview of Report

The remainder of this report consists of two chapters. Chapter 2 describes the sample design, data, and statistical methods used. Results are presented in Chapter 3.

The reader should be aware that this report is the final in a series of reports that have been produced as part of this cooperative agreement. The previous reports include the following:

- Burge, Russel T., Janet B. Mitchell, and L. William Katz, Case Study of Teaching Hospitals, 1994. This report synthesized the case study finding from nine teaching facilities across the U.S., including both academic medical centers and other teaching institutions. These case studies documented variations in the organizational structures and governing policies of faculty practice plans, billing procedures, the distribution of plan funds, and alternative methods of physician compensation. Individual case study reports were also produced for each of the nine hospitals.

- Mitchell, Janet B., Russel T. Burge, and Diane N. McPartlin. Teaching Physicians and the Medicare Program, 1995. This extremely detailed report included analysis of the 1991 sample of hospitals, and included data from Part A and Part B claims, Medicare Cost Reports, and the Intern and Resident Information System (IRIS) database. Analyses were conducted at both the hospital and the admission level, comparing per admission payments for direct medical education, indirect medical education, Part B, and PPS.

2.0 DATA AND METHODS

2.1 Sample Design

2.1.1 Design of Initial 1991 Sample

We developed a four-group categorization of teaching hospitals, using a typology similar to that used by Welch (1987) and Anderson *et al.* (1989). The four categories are:

1. **Academic medical centers.** These institutions are defined by the Association of American Medical Colleges (AAMC) as hospitals that are: (1) affiliated with a medical school; (2) members of the Council of Teaching Hospitals (COTH); and (3) either are under common ownership with a college of medicine, or have the majority of medical school department chairs as the hospital chiefs of service, or have the chairperson responsible for appointing the hospital chief of service.

2. **Other COTH hospitals.** These hospitals are members of COTH but do not meet the other criteria for academic medical centers as defined by the AAMC.

3. **Other teaching hospitals.** These hospitals are not COTH members but do have residents and are considered teaching hospitals for PPS payment purposes.

4. **Non-teaching hospitals.** These hospitals do not train residents and receive no medical education payments under PPS.

Because of the sheer claims volume (especially for Part B), we needed to select a sample of hospitals within each type. To do this, we obtained the 1991 Provider of Service (POS) file from HCFA which includes all hospitals receiving PPS payments in that year. We then limited the file to short-term general hospitals in the 50 states and the District of Columbia, which resulted in universe of 5,292 hospitals for sample selection.

Each of the 5,292 hospitals were assigned to one of the four teaching categories. We had received a list of the names of all academic medical centers from the AAMC, which were then matched with the provider names on our hospital file. Other COTH hospitals were identified based on the COTH designation contained in the American Hospital Association files (which

had been merged onto the POS file). All other teaching hospitals were those non-COTH members with at least one resident, based on HCFA's POS file. The distribution of hospitals across these four groups is displayed in Table 2-1.

Based on the goals of our analyses, we decided to select a stratified random sample with the four hospital categories defining the strata. Within each category stratum, hospitals were stratified first by census division and then by three urban-rural classes (large urban, small urban, and rural). Within these sub-strata, hospitals were sorted by MSA, number of Medicare discharges, and bedsize. Hospitals were then selected within each sub-stratum based on probability proportional to size sampling, using Medicare discharges as the size measure. Due to their small numbers, all academic medical centers and the majority of other COTH hospitals were selected into the sample.

A total of 720 hospitals were selected for 1991: 120 academic medical centers, 120 other COTH hospitals, 240 other teaching hospitals, and 240 non-teaching hospitals. Each hospital had a sampling weight based on the probability of its selection. These weights were used in all analyses in order to generalize back to the universe of all hospitals.

2.1.2 Construction of Final Analytic Sample

Our MFS impact analysis required a full three years' worth of data (1991-1993). After initial sample selection in 1991, however, 13 of the sample hospitals either closed or merged with another hospital. In one case, the merger took place between two sample hospitals, allowing us to retain both hospitals in the study. The merger appeared to have begun in 1992, and we created a single merged entity for all three years. In the remaining merger cases, the merger took place with a hospital *outside* the sample and the observation had to be dropped from the analysis. A total of 12 observations were dropped due to closure or merger.

Since the focus of our analysis is on how the MFS affected Part B revenues, we needed to limit teaching hospital cases to those whose physicians have *not* exercised the cost-election option. Currently, physicians in teaching hospitals have the option to forego fee-for-service billing and instead receive a retrospective cost-based payment to cover all physician services provided to Medicare beneficiaries. This option was intended to relieve teaching hospitals of the administrative costs associated with documenting an attending physician relationship, or with tracking supervised vs. personally performed services.

TABLE 2-1

HOSPITAL UNIVERSE, INITIAL SAMPLE SELECTION, AND FINAL SAMPLE

	Universe	Initial Sample	*Dropped due to:* Merger/ Closure	Cost-Election	Final Sample
Academic Medical Centers	120	120	0	4	116
Other COTH Hospitals	180	120	0	0	120
Other Teaching Hospitals	889	240	7	3	230
Non-Teaching Hospitals	4,103	240	5	--	235
TOTAL	**5,292**	**720**	**12**	**7**	**701**

SOURCE: Medicare Provider of Service files.

HCFA provided us with a list of all hospital provider IDs that were on cost election in 1987-88. We then called the ten HCFA regional offices to determine which hospitals still were exercising the cost election option during our study period (1991-1993), and to verify whether cost election applied to the entire acute care hospital or only to selected units (e.g., psychiatric). In some instances, we also called the fiscal intermediaries in order to double-check the status of a given hospital. A total of seven teaching hospitals in our sample were found to be operating under the cost election option, and subsequently were dropped from further analysis.[1] Table 2-1 presents the distribution of the initial and final samples of hospitals by teaching category.

2.2 Data Sources

Medicare Part A and Part B claims constituted the primary data sources for this study. For each of the three study years, all MedPAR records were extracted for each of the sample hospitals. Using the HIC numbers on these records, we then extracted all of the Part B claims associated with those admissions (based on admission and discharge dates).

2.3 Variable Measurement and Construction

2.3.1 Physician Service Categories

Three key analytic variables were constructed for each hospital-year: Part B revenues per admission, relative value units (RVUs) per admission, and a price index. These are described in detail below. Each of these variables was created for overall inpatient physician services, and then for five separate categories of services:

1. **Evaluation and management services.** These primarily include hospital visits, inpatient consultations, and critical care services.

[1] These included four academic medical centers (LAC-USC Medical Center in Los Angeles, Kings County and Bellevue Hospitals in New York City, and Charity Hospital in New Orleans), and three "other teaching" hospitals (Woodhull Medical Center in New York City, and the University and Huey Long Medical Centers in Louisiana).

2. **High-tech surgical procedures.** These are complex operations requiring relatively greater physician skill and expertise, and were defined as those procedures with RVUs of 40 or more. High-tech surgery includes cardiac bypass procedures, angioplasty, major joint replacements, brain surgery, etc.

3. **General surgical procedures.** All other surgical procedures (i.e., with RVUs less than 40) are in this category, including endoscopies.

4. **High-tech tests.** These are diagnostic tests requiring relatively greater physician skill and associated equipment, and were defined as those tests with RVUs of 1.3 or greater. Examples of high-tech tests include cardiac catheterization, CT and MRI scans, etc.

5. **Routine tests.** All other tests (i.e., with RVUs less than 1.3) are included in this category.

2.3.2 Revenues Per Admission

Part B revenues are simply the sum of all Part B allowed charges for inpatient services, which are then expressed on a per admission basis. Most analyses are limited to those physician services whose payments are based on the RBRVS. In these cases, we exclude payments for anesthesia and for ECGs. Anesthesia reimbursement is based on a separate (anesthesia-specific) relative value scale that is not directly comparable to the RBRVS. Separate reimbursement for ECG interpretation was eliminated beginning in 1992. (It was reinstated later in 1994, after the conclusion of our study period.)

2.3.3 RVUs Per Admission

Changes in revenues represent the combined effect of changes in fees (resulting from RBRVS) and changes in the volume of services. In order to disentangle the two, we calculated the number of RVUs per admission as follows. Medicare's RVUs for 1993 were merged onto the raw Part B claims by CPT code and modifier. (Constant RVUs were used for each study year in order to hold constant the minor tinkering with RVU values that took place over this period.) RVUs were then summed and expressed on a per admission basis.

2.3.4 Price Index

MFS impacts on physicians were measured by the construction of price indices for five different types of services:

1. evaluation and management services;
2. high-tech surgery;
3. other (general) surgery;
4. high-tech tests; and
5. other (routine) tests.

A "market-basket" of high-volume procedures was selected to be representative of each group of services. These included:

1. **evaluation and management:** hospital visits and consultations;
2. **high-tech surgery:** CABG surgery, PTCA, total hip replacement, and total knee replacement;
3. **other surgery:** cholecystectomy, TURP, carotid endarterectomy, partial colectomy, colonoscopy, and upper GI endoscopy;
4. **high-tech tests:** CT scan of the head, MRI scan of the brain, cardiac catheterization, and echocardiography; and
5. **other tests:** chest x-ray, hip x-ray, barium enema, and non-invasive cerebrovascular studies.

The average fee was calculated as the sum of allowed charges for a given group of services (e.g., hospital visits) divided by the number of services. All CPT-4 codes for these procedures were used; thus, the average fee per hospital visit reflects the mix of visit codes being billed by physicians at a given hospital. All fees were hospital-specific, i.e., based on the actual allowed charges of physicians at each hospital. We rejected the use of exogenous fees, as the average allowed charges received by teaching physicians were expected to vary systematically from those for the locality as a whole.

A weighted average fee for each service group then was calculated as the weighted sum of individual fees, using hospital-specific base-year weights. Thus, the weight for the hospital visit fee in the evaluation and management index was total 1991 allowed charges for hospital visits divided by the sum of 1991 allowed charges for hospital visits and consultations, e.g.,

$$P_{E\&M} = P_{HV}\left(\frac{CHG_{HV}}{CHG_{HV} + CHG_C}\right) + P_C\left(\frac{CHG_C}{CHG_{HV} + CHG_C}\right)$$

where P = mean fee; CHG = total allowed charges; and the subscripts E&M, HV, and C refer to evaluation and management, hospital visits, and consultations, respectively.

The index for each service group then was constructed by dividing through the weighted average fee for each year by the 1991 weighted average fee. Thus, the index value for each hospital was set equal to 1.0 in the base year (1991).

Finally we constructed an overall price index. This enabled us to evaluate the differential impact of rising vs. declining prices under the MFS. We expected average fees for evaluation and management services to increase, for example, while fees for high-tech surgery should fall as the result of RBRVS. The overall index was calculated as the weighted sum of the five service group indices, where the weights represented each service group's share of total allowed charges at that hospital. Thus, the weight for the evaluation and management index was total 1991 allowed charges for evaluation and management services (including all such services, not just the two comprising the index) divided by total 1991 allowed charges for all service types captured by the five indices. (We excluded allowed charges for anesthesia from the denominator, as these payments were not based on the RBRVS. We also excluded allowed charges for some miscellaneous services that did not fit into any of the five categories, e.g., inpatient dialysis. Payments for these miscellaneous services averaged only 2 percent of total allowed charges per admission.)

Our price index represents the change in Medicare payments that would have been received as a result of the MFS, *assuming no change in the mix of services*. It is possible, however, that service mix could change due to changes in technology or casemix or in response to the MFS itself. For this reason, we also calculated a price per RVU, by dividing each hospital's allowed charges by its RVUs. Since this measure was based on the current year's mix of services, it may

provide a more accurate representation of the price actually paid. The resulting dollar values can be considered as conversion factors, the dollar amount needed to multiply times RVUs to determine Medicare payments.

2.3.5 Casemix Index

It is possible (although unlikely over the short study period) that any changes in revenue per admission could be due to casemix changes. In order to adjust for this, we created an annual casemix index (CMI) for each hospital. Rather than calculating a CMI using PPS weights, we constructed a CMI based on physician services. Under another HCFA project (Mitchell *et al.*, 1995), we had calculated DRG weights based on total physician RVUs associated with each admission. Thus, these weights reflect relative physician service intensity. They were constructed from the 1992 Episode Database and are representative of all Medicare admissions in the US. These RVU-based DRG weights then were used to construct a casemix index in the same way that PPS weights are used to construct the Medicare CMI for hospital payment purposes.

2.4 Statistical Tests

The hospital-year constituted the unit of observation. While three years of data are presented, our primary focus is on the change from 1991 (just prior to MFS implementation) to 1993 (the second year under the MFS).

T-tests were used to determine the statistical significance of changes in revenues, RVUs, and prices over time. All analyses were weighted by the hospital's sampling weight, as well as by its total number of Medicare admissions.

Regression analysis was used to test whether physicians in teaching hospitals experienced significantly larger (smaller) revenue changes over time, compared with those in non-teaching hospitals. The percent change in revenue was regressed on three dummy variables for academic medical centers, other COTH hospitals, and other teaching hospitals, respectively. Non-teaching hospitals constituted the omitted group. A similar regression equation was estimated to determine whether public teaching hospitals were adversely affected relative to private institutions.

3.0 RESULTS

3.1 Changes in Inpatient Revenues Per Admission

Table 3-1 presents allowed charges per admission by type of hospital: in total and for individual groups of services. Total inpatient revenues declined by about one-fifth over the three-year period for physicians in all types of hospitals. If anything, the revenue reduction appears relatively larger in non-teaching hospitals. We test whether these rates of change are significantly different across hospitals in a later section (see Table 3-3, for example). As these dollars have not been adjusted for inflation, this understates somewhat the *real* change in revenues. Furthermore, inpatient revenues fell in all groups of services, even evaluation and management, which is puzzling given the increased fees for these services (shown in Table 3-3 below). We will investigate this in more detail later, when we disaggregate evaluation and management and examine changes for specific services.

Inpatient revenues fell dramatically for both high-tech surgeries and other surgeries. While levels of surgical spending per admission were considerably higher in teaching hospitals than in non-teaching hospitals, the rates of decline appear surprisingly similar. Not surprisingly, as payments for assistance at surgery are based on a fixed percentage of the surgeon's bill, revenues for this service category also fell. (The very low level of spending on assistance at surgery in academic medical centers reflects the use of residents as assistants. Medicare regulations prohibit billing for surgical assistance in hospitals that offer a residency program in that surgical specialty.)

Although anesthesia payments were not based on the RBRVS, their conversion factors were markedly reduced for budget neutrality reasons at the time the MFS was implemented. Presumably, this explains the significant decline in anesthesia revenues from 1991 to 1993. It is possible, of course, that the amount of surgery actually performed also declined over this time period, thus reducing the demand for anesthesia. We examine this explicitly later in section 3.5.

Revenues for high-tech tests plummeted over the three-year period. As with surgical procedures, this is not unexpected as payments for both high-tech diagnostic tests and surgical procedures were rolled-back substantially under the MFS. Revenues for other, routine tests fell by even higher amounts, about 40 percent from 1991 to 1993. This was due in large part to the

TABLE 3-1

CHANGES IN PART B INPATIENT ALLOWED CHARGES PER ADMISSION: 1991 - 1993

Allowed Charges/Admission	1991	1992	1993	Percent Change
Total Part B				
Academic Medical Centers	$1,782.97	$1,510.39	$1,408.44	-21.0 %**
Other COTH Hospitals	1,714.06	1,450.55	1,378.58	-19.6 **
Other Teaching Hospitals	1,472.82	1,263.92	1,174.74	-20.2 **
Non-Teaching Hospitals	1,184.58	977.90	913.98	-22.8 **
Evaluation and Management				
Academic Medical Centers	441.55	419.32	430.83	-2.4 **
Other COTH Hospitals	543.69	528.13	537.91	-1.1
Other Teaching Hospitals	489.04	475.97	475.46	-2.8
Non-Teaching Hospitals	442.70	415.19	414.53	-6.4 **
High-Tech Surgeries				
Academic Medical Centers	357.75	317.94	285.57	-20.2 **
Other COTH Hospitals	283.73	248.56	228.98	-19.3 **
Other Teaching Hospitals	212.97	197.89	179.50	-15.7 **
Non-Teaching Hospitals	119.12	111.52	100.07	-16.0 **
Other Surgeries				
Academic Medical Centers	391.09	352.87	324.03	-17.1 **
Other COTH Hospitals	354.08	306.39	284.55	-19.6 **
Other Teaching Hospitals	300.57	264.27	240.10	-20.1 **
Non-Teaching Hospitals	252.58	213.29	195.01	-22.8 **
Assistance at Surgery				
Academic Medical Centers	8.40	7.13	6.57	-21.8 **
Other COTH Hospitals	21.70	19.11	17.17	-20.9 **
Other Teaching Hospitals	25.53	22.16	19.50	-23.6 **
Non-Teaching Hospitals	21.80	18.24	16.51	-24.3 **
Anesthesia				
Academic Medical Centers	147.53	126.28	113.27	-23.2 **
Other COTH Hospitals	118.53	101.38	93.52	-21.1 **
Other Teaching Hospitals	95.72	86.23	77.31	-19.2 **
Non-Teaching Hospitals	68.87	61.73	55.11	-20.0 **

TABLE 3-1 (continued)

CHANGES IN PART B INPATIENT ALLOWED CHARGES PER ADMISSION: 1991 - 1993

Allowed Charges/Admission	1991	1992	1993	Percent Change
High-Tech Tests				
Academic Medical Centers	190.91	164.47	147.91	-22.5 %**
Other COTH Hospitals	165.73	143.48	129.33	-22.0 **
Other Teaching Hospitals	141.99	122.73	108.56	-23.5 **
Non-Teaching Hospitals	93.60	81.24	72.47	-22.6 **
Other Tests (Including ECGs)				
Academic Medical Centers	86.06	57.90	50.23	-41.6 **
Other COTH Hospitals	77.47	51.46	47.20	-39.1 **
Other Teaching Hospitals	67.59	46.84	41.71	-38.3 **
Non-Teaching Hospitals	61.64	41.84	38.03	-38.3 **
ECGs				
Academic Medical Centers	21.05	0.14	0.03	-99.9 **
Other COTH Hospitals	21.31	0.15	0.03	-99.9 **
Other Teaching Hospitals	17.21	0.07	0.02	-99.9 **
Non-Teaching Hospitals	15.16	0.05	0.02	-99.9 **
Total Part B (RBRVS-based only)				
Academic Medical Centers	$1,614.39	$1,383.98	$1,295.14	-19.8 %**
Other COTH Hospitals	1,574.21	1,349.02	1,285.04	-18.4 **
Other Teaching Hospitals	1,359.88	1,177.62	1,097.40	-19.3 **
Non-Teaching Hospitals	1,100.55	916.11	858.85	-22.0 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

elimination of separate reimbursement for ECG interpretation. Revenues from ECGs averaged $15-20 per admission in 1991, or about one percent of total Part B revenues.

At the bottom of Table 3-1, we present the change in total allowed charges per admission, *for those services whose payments are based on the RBRVS only.* Thus, anesthesia and ECGs are excluded. These percent changes were not appreciably different from those shown at the top of Table 3-1, however. These RBRVS-based services will be the focus of all subsequent analyses.

3.2 Differential Change by Hospital Ownership

Many teaching hospitals, especially academic medical centers, are government-owned facilities that serve a disproportionate number of low-income patients. Some policymakers have expressed concern that if *public* teaching hospitals were particularly hard-hit by the MFS, then access to care could become a problem for the elderly poor who use these facilities.

Table 3-2 compares the 1991-1993 percent change in revenue for physicians in voluntary, proprietary, and government-owned hospitals. There were no significant differences between voluntary and government-owned hospitals; inpatient revenues fell by 20 percent, for example, in both public and private academic medical centers. Inconsistent results for proprietary hospitals can be attributed to the relatively small number of these facilities. Only 16 of the 60 proprietary hospitals were teaching institutions.

3.3 Changes in Revenues, RVUs and Prices for All Services

3.3.1 Time Trends in Overall Revenues, RVUs, and Prices

Table 3-3 displays the 1991-1993 time trend in revenues per admission (as shown earlier in Table 3-1), along with inpatient RVUs per admissions, the average price per service index, and the average price per RVU. The price per service index is based on the allowed charge per service for a market-basket of high-volume services, as described in Chapter 2. This index was constructed, using base period weights, and thus represents the price reduction that would have taken place under MFS *had the mix of services remained unchanged from 1991.* The price per RVU, on the other hand, is based on the current year's mix of services and represents the *effective* price change experienced by physicians at each hospital.

TABLE 3-2

PERCENT CHANGE IN PART B ALLOWED CHARGES PER ADMISSION BY HOSPITAL OWNERSHIP, 1991-1993

	HOSPITAL OWNERSHIP			
	Voluntary (n=526)	Proprietary (n=60)	Government (n=115)	All
Academic Medical Centers	-19.6 %	-19.7 %	-20.0 %	-19.8 %
Other COTH Hospitals	-18.4	-9.6	-19.1	-18.4
Other Teaching Hospitals	-18.7	-24.8 *	-20.8	-19.3
Non-Teaching Hospitals	-21.3	-24.7 *	-22.1	-22.0

* Significantly different from voluntary hospitals at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-3

CHANGES IN TOTAL REVENUES, RVUs, AND PRICES PER ADMISSION, 1991 - 1993

	1991	1992	1993	Percent Change
Allowed Charges/Admission				
Academic Medical Centers	$1,614.39	$1,383.98	$1,295.14	-19.8 %**
Other COTH Hospitals	1,574.21	1,349.02	1,285.04	-18.4 **[a]
Other Teaching Hospitals	1,359.88	1,177.62	1,097.40	-19.3 **[a]
Non-Teaching Hospitals	1,100.55	916.11	858.85	-22.0 **
RVUs/Admission				
Academic Medical Centers	40.73	37.92	36.37	-10.7 **
Other COTH Hospitals	40.71	37.18	36.20	-11.1 **
Other Teaching Hospitals	38.22	35.41	33.61	-12.1 **
Non-Teaching Hospitals	30.57	28.31	26.88	-12.1 **
Average Price Per Service Index				
Academic Medical Centers	1.00	0.90	0.85	-15.3 **[a]
Other COTH Hospitals	1.00	0.92	0.89	-10.7 **[a]
Other Teaching Hospitals	1.00	0.94	0.92	-7.9 **[a]
Non-Teaching Hospitals	1.00	0.95	0.97	-3.3 **
Average Price Per RVU				
Academic Medical Centers	$40.03	$36.66	$35.66	-10.9 %**
Other COTH Hospitals	39.48	36.75	35.98	-8.9 **
Other Teaching Hospitals	36.67	33.92	33.13	-9.7 **[b]
Non-Teaching Hospitals	36.25	32.53	32.24	-11.1 **

** Percent change from 1991 to 1993 significant at the 0.01 level.

* Percent change from 1991 to 1993 significant at the 0.05 level.

[a] Significantly different from non-teaching hospitals at the 0.01 level.

[b] Significantly different from non-teaching hospitals at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

Besides testing the significance of the percent changes from 1991 to 1993 for each hospital group, we also tested whether the percent change in allowed charges per admission experienced by physicians in teaching hospitals was significantly different from that of non-teaching physicians. As shown in Table 3-3, physicians in other COTH and other teaching hospitals enjoyed significantly smaller revenue reductions, compared with their non-teaching colleagues. There were no significant differences between academic medical center physicians and those in non-teaching hospitals.

Surprisingly, given historical trends during the 1980's (Miller and Welch, 1993; Mitchell, 1993), physician service intensity declined over the study period, falling 12-13 percent in all types of hospitals. (These RVU declines were not significantly different across hospital types.) As discussed in Chapter 1, we hypothesized that financial pressures (including the MFS) would encourage physicians in teaching hospitals to bill for services they provided (but which historically may have been under-reported). There is no reason to expect the opposite to have occurred; thus, it appears that the true number of inpatient services per admission fell from 1991 to 1993.

While the price per service index declined significantly for all types of hospitals, the absolute magnitude of the decline increased with teaching intensity. While prices fell 3 percent on average in non-teaching hospitals, academic medical centers experienced a price reduction five times greater (15%). These differences are consistent with our hypothesis that teaching hospitals in general, and academic medical centers in particular, would receive significantly larger price reductions because of their relatively greater emphasis on high-tech tests and procedures (which were targeted for large roll-backs under MFS).

The average price per RVU showed considerably less variation across hospital types, on the other hand, declining between 9 and 11 percent.[1] Thus, the *effective* price change was considerably lower than expected for teaching hospitals (e.g., 11% vs. 15% in academic medical centers), and higher than expected for non-teaching hospitals (11% vs. 3%). This suggests that physicians modified the mix of services they provided (and billed for) over this time period.

[1] These dollar values can be considered as conversion factors, the dollar amount needed to multiply times RVUs to determine Medicare payments. They will differ, of course, from the actual published conversion factors in effect for 1992 and 1993, since they reflect the appropriate GPCIs and since they represent blended transition payment amounts.

3.3.2 Decomposition of Change in Overall Revenues (Allowed Charges)

Table 3-4 decomposes the revenue decline by hospital type. The percent changes in revenues per admission, price per service, price per RVU, and RVUs per admission shown in Table 3-3 are presented here in columns 1, 2, 3, and 5 respectively. A measure of procedure intensity within service (i.e., S/RVU) is calculated as a simple subtraction of the price per service from the price per RVU and is shown in column 4.

From Table 3-4, we see that the contributions of price per RVU and RVUs per admission to the declines in revenue are strikingly similar across the four hospital groups. However, as noted above, the reduction in price per service was far larger in teaching, than in non-teaching, hospitals. Teaching physicians, especially those in academic medical centers, appear to have partially offset this potential price reduction by providing more services per RVU. This runs counter to our hypothesis that teaching physicians would be providing a more complex mix of services over time (i.e., an increase in RVU/S, rather than an increase in its inverse, S/RVU, as observed here). We suspect that teaching physicians have altered their mix of services, by substituting less RVU-intensive visits for high-tech tests and procedures.

By contrast, non-teaching physicians were expected to experience only a relatively minor reduction in price per service (3%), but instead received a much larger effective price reduction of 11 percent based on the price per RVU. This means that non-teaching physicians provided a *more* RVU-intensive package of services over time. (The 7.8% decline in services per RVU is the same as a 7.8 % increase in RVUs per service.).

In the sections that follow, we examine changes in revenues, RVUs, and prices for individual groups of services. These decompositions will shed further light on these overall changes.

3.4 Changes in Revenues, RVUs, and Prices for Evaluation and Management Services

Table 3-5 displays the 1991-1993 time trend in revenues per admission, along with inpatient RVUs per admissions, the average price per service index, and the average price per RVU. This table is identical in format to Table 3-3 shown earlier, but here all variables are calculated for evaluation and management (E&M) services only. As noted earlier, E&M revenues per admission fell among all hospital types, although the percent declines were

TABLE 3-4

DECOMPOSITION OF PART B REVENUE DECLINES PER ADMISSION INTO PRICE AND QUANTITY CHANGES: 1991-1993

	Revenues Per Admission (1)	Price Per Service (2)	Price Per RVU (3)	Services Per RVU* (4)	RVUs Per Admission (5)
Academic Medical Centers	-19.8%	-15.3%	-10.9%	4.4%	-10.7%
Other COTH Hospitals	-18.4	-10.7	-8.9	1.8	-11.1
Other Teaching Hospitals	-19.3	-7.9	-9.7	-1.8	-12.1
Non-Teaching Hospitals	-22.0	-3.3	-11.1	-7.8	-12.1

* Based on simple subtraction of column (2) from column (3).

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-5

CHANGES IN REVENUES, RVUs, AND PRICES PER ADMISSION FOR EVALUATION AND MANAGEMENT SERVICES: 1991 - 1993

	1991	1992	1993	Percent Change
Allowed Charges/Admission				
Academic Medical Centers	$441.55	$419.32	$430.83	-2.4 %*
Other COTH Hospitals	543.69	528.13	537.91	-1.1
Other Teaching Hospitals	489.04	475.97	475.46	-2.8
Non-Teaching Hospitals	442.70	415.19	414.53	-6.4 *
RVUs/Admission				
Academic Medical Centers	11.01	11.34	11.57	5.1 **
Other COTH Hospitals	13.04	13.41	13.73	5.3 **
Other Teaching Hospitals	12.87	12.85	12.79	-0.6
Non-Teaching Hospitals	12.09	11.73	11.48	-5.0 *
Price Per Service Index				
Academic Medical Centers	1.00	1.03	1.07	7.2 **
Other COTH Hospitals	1.00	1.01	1.06	6.1 **
Other Teaching Hospitals	1.00	1.05	1.10	10.0 **
Non-Teaching Hospitals	1.00	1.07	1.12	12.5 **
Average Price Per RVU				
Academic Medical Centers	$39.79	$36.71	$37.00	-7.0 **
Other COTH Hospitals	41.76	39.33	39.23	-6.1 **
Other Teaching Hospitals	37.82	36.91	37.05	-2.1 *
Non-Teaching Hospitals	35.81	35.04	35.91	0.0

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

relatively small compared with those for total revenues. The intensity of E&M services (RVUs/admission) increased significantly in academic medical centers and other COTH hospitals; this is consistent with our hypothesis that higher payments for hospital visits would encourage these teaching physicians to bill for these services. Surprisingly, E&M volume actually declined in non-teaching hospitals.

The price per E&M service index increased over time as expected for physicians in all types of hospitals. The magnitude of the increase was relatively smaller for teaching than for non-teaching physicians. This presumably reflects the GPCI component of the MFS which raised fees relatively more in rural areas than in urban areas. Teaching hospitals, especially academic medical centers, are disproportionately located in large urban areas.

While the MFS raised fees for E&M services, the price per E&M RVU actually fell for teaching physicians and remained constant for those in non-teaching hospitals. This means that physicians altered the mix of E&M services they provided over this time period. We see this more clearly in Table 3-6 where we decompose the percent change in E&M revenues, using the same methodology shown earlier for total revenues (Table 3-4). For physicians in academic medical centers and other COTH hospitals, the increase in quantity was more than offset by the reduction in effective price. Why are prices declining for E&M RVUs when the MFS explicitly raised the price for these services? The answer lies in the changing mix of E&M services.

Table 3-7 presents time trends for the three major components of E&M services: hospital visits, consultations, and critical care visits. Revenues increased for both hospital visits and consultations in all types of hospitals, but fell precipitously for critical care visits, especially among non-teaching hospitals. This is due to a coding change that was introduced at the same as MFS. Prior to 1992, physicians used critical care codes to bill for visits in ICUs or CCUs. Under the MFS, the new critical care codes are to be used only for seriously ill patients who need prolonged attendance by the physician. Routine ICU visits are to be billed as hospital visits. Thus, the observed increase in hospital visit RVUs may largely reflect the substitution of hospital visits for critical care visits.

3.5 Changes in Revenues, RVUs, and Prices for High-Tech Surgery

Table 3-8 presents time trends for high-tech surgical procedures. As noted earlier, revenues per admission fell considerably in all types of hospitals. There was little change in the

TABLE 3-6

DECOMPOSITION OF CHANGE IN REVENUES PER ADMISSION FOR EVALUATION AND MANAGEMENT SERVICES INTO PRICE AND QUANTITY CHANGES: 1991-1993

	Revenues Per Admission (1)	Price Per Service (2)	Price Per RVU (3)	Services Per RVU* (4)	RVUs Per Admission (5)
Academic Medical Centers	-2.4%	7.2%	-7.0%	-14.2%	5.1%
Other COTH Hospitals	-1.1	6.1	-6.1	-12.2	5.3
Other Teaching Hospitals	-2.8	10.0	-2.1	-12.1	-0.6
Non-Teaching Hospitals	-6.4	12.5	0.0	-12.5	-5.0

* Based on simple subtraction of column (2) from column (3).

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-7

CHANGES IN EVALUATION AND MANAGEMENT ALLOWED CHARGES AND RVUs BY TYPE OF VISIT

Allowed Charges/Admission	1991	1992	1993	Percent Change
Hospital Visits				
Academic Medical Centers	$251.73	$255.67	$256.89	2.1 %
Other COTH Hospitals	324.11	339.93	330.66	2.0
Other Teaching Hospitals	288.27	313.05	302.64	5.0 **
Non-Teaching Hospitals	256.27	276.81	264.77	3.3
Consultations				
Academic Medical Centers	70.93	77.71	74.94	5.6 **
Other COTH Hospitals	93.72	103.62	102.59	9.5 **
Other Teaching Hospitals	79.50	89.44	86.91	9.3 **
Non-Teaching Hospitals	61.93	69.00	68.44	10.5 **
Critical Care Visits				
Academic Medical Centers	46.97	28.95	28.94	-38.4 **
Other COTH Hospitals	50.37	25.63	29.45	-41.5 **
Other Teaching Hospitals	47.16	17.40	18.63	-60.5 **
Non-Teaching Hospitals	49.85	16.73	16.01	-67.9 **
Total Evaluation and Management Services				
Academic Medical Centers	441.55	419.32	430.83	-2.4 *
Other COTH Hospitals	543.69	528.13	537.91	-1.1
Other Teaching Hospitals	489.04	475.97	475.46	-2.8
Non-Teaching Hospitals	442.70	415.19	414.53	-6.4 *
RVUs/Admission				
Hospital Visits				
Academic Medical Centers	5.50	6.08	6.20	12.7 **
Other COTH Hospitals	6.59	7.57	7.49	13.7 **
Other Teaching Hospitals	6.66	7.54	7.33	10.0 **
Non-Teaching Hospitals	6.40	7.16	6.68	4.4 *
Consultations				
Academic Medical Centers	2.40	2.55	2.45	2.0
Other COTH Hospitals	3.03	3.19	3.19	5.2 **
Other Teaching Hospitals	2.75	2.90	2.81	2.3
Non-Teaching Hospitals	2.17	2.26	2.23	2.7
Critical Care Visits				
Academic Medical Centers	1.44	1.12	0.99	-31.4 **
Other COTH Hospitals	1.48	0.88	0.89	-39.7 **
Other Teaching Hospitals	1.48	0.66	0.60	-59.4 **
Non-Teaching Hospitals	1.57	0.64	0.55	-65.1 **
Total Evaluation and Management Services				
Academic Medical Centers	11.01	11.34	11.57	5.1 **
Other COTH Hospitals	13.04	13.41	13.73	5.3 **
Other Teaching Hospitals	12.87	12.85	12.79	-0.6
Non-Teaching Hospitals	12.09	11.73	11.48	-5.0 *

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-8

CHANGES IN REVENUES, RVUs, AND PRICES PER ADMISSION FOR HIGH-TECH SURGERY: 1991 - 1993

	1991	1992	1993	Percent Change
Allowed Charges/Admission				
Academic Medical Centers	$357.75	$317.94	$285.57	-20.2 **
Other COTH Hospitals	283.73	248.56	228.98	-19.3 **
Other Teaching Hospitals	212.97	197.89	179.50	-15.7 **
Non-Teaching Hospitals	119.12	111.52	100.07	-16.0 **
RVUs/Admission				
Academic Medical Centers	8.18	8.55	7.91	-3.2 **
Other COTH Hospitals	6.32	6.46	6.14	-2.8
Other Teaching Hospitals	5.16	5.54	5.17	0.1
Non-Teaching Hospitals	2.96	3.19	2.92	-1.4
Price Per Service Index				
Academic Medical Centers	1.00	0.83	0.63	-36.6 **
Other COTH Hospitals	1.00	0.88	0.71	-28.6 **
Other Teaching Hospitals	1.00	0.88	0.77	-23.2 **
Non-Teaching Hospitals	1.00	0.79	0.73	-26.8 **
Average Price Per RVU				
Academic Medical Centers	$44.05	$37.44	$36.27	-17.7 **
Other COTH Hospitals	45.58	39.18	37.94	-16.8 **
Other Teaching Hospitals	42.02	35.99	35.13	-16.4 **
Non-Teaching Hospitals	38.45	33.87	32.84	-14.6 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

intensity of high-tech surgery per admission (RVU/ADM), although the small decline (-3.2%) in academic medical centers was statistically significant. This suggests that revenues for high-tech surgery fell largely because of the MFS fee reductions. In fact, the average price per service reductions were considerable, as high as 37 percent in academic medical centers. However, the effective fee reduction (percent change in price per RVU) was only about half as large, suggesting a change in procedure mix that partially offset the MFS roll-backs. We seem this more clearly in the decomposition in Table 3-9. Within procedure-intensity actually declined over time, as evidenced by the increase in services per RVU. We suspect that this is largely an artifact of coding changes; the procedure codes for CABG surgery were expanded, for example, requiring surgeons to bill multiple codes per service for many surgeries even though the total average work effort (number of RVUs per operation) remained unchanged.

Changes for four high-volume high-tech surgical procedures are displayed in Table 3-10: CABG surgery, PTCA, total hip replacement, and total knee replacement. Revenues fell dramatically for all four of these procedures, especially among teaching hospitals. (Note: revenues and RVUs are averaged across all admissions within the hospital.) These reductions appear largely due to lowered fees, as there was relatively little change in the RVUs for these procedures. Hip and knee replacement RVUs did decline significantly among academic medical centers, however, suggesting that physicians in these hospitals either performed fewer of these procedures or performed less complex versions of these operations. (There were no coding changes introduced for these procedures during our study period.)

3.6 Changes in Revenues, RVUs, and Prices for General Surgical Procedures

Somewhat surprisingly, the volume of general surgical procedures fell considerably more on a per admission basis than did high-tech procedures, especially in non-teaching hospitals (Table 3-11). Paradoxically, general surgery RVUs per admission actually increased in academic medical centers. Although the price per service reductions were not as large as those for high tech surgery, they were still considerable ranging from 14 to 16 percent over the study period. Furthermore, effective price reductions were as large (or larger), suggesting that there were not any offsetting changes in procedure mix. We see this more clearly in the decomposition in Table 3-12, where services per RVU change only slightly.

TABLE 3-9

DECOMPOSITION OF CHANGE IN REVENUES PER ADMISSION FOR HIGH-TECH SURGERY INTO PRICE AND QUANTITY CHANGES: 1991-1993

	Revenues Per Admission (1)	Price Per Service (2)	Price Per RVU (3)	Services Per RVU* (4)	RVUs Per Admission (5)
Academic Medical Centers	-20.2%	-36.6%	-17.7%	18.9%	-3.2%
Other COTH Hospitals	-19.3	-28.6	-16.8	11.8	-2.8
Other Teaching Hospitals	-15.7	-23.2	-16.4	6.8	0.1
Non-Teaching Hospitals	-16.0	-26.8	-15.4	11.4	-1.4

* Based on simple subtraction of column (2) from column (3).

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-10

CHANGES IN ALLOWED CHARGES AND RVUs FOR HIGH-TECH SURGERY BY SELECTED SURGICAL PROCEDURE

Allowed Charges/Admission	1991	1992	1993	Percent Change
CABG Surgery				
Academic Medical Centers	$105.91	$92.20	$81.00	-23.5 %**
Other COTH Hospitals	94.71	82.36	74.23	-21.6 **
Other Teaching Hospitals	63.03	57.10	51.13	-18.9 *
Non-Teaching Hospitals	20.78	20.19	17.66	-15.0
PTCA				
Academic Medical Centers	36.35	35.87	30.11	-17.2 **
Other COTH Hospitals	40.79	38.46	32.28	-20.9 **
Other Teaching Hospitals	27.34	26.89	22.36	-18.2 *
Non-Teaching Hospitals	12.40	12.67	9.55	-23.0
Hip Replacement				
Academic Medical Centers	25.44	20.75	19.78	-22.3 **
Other COTH Hospitals	26.02	21.11	20.76	-20.2 **
Other Teaching Hospitals	27.11	23.02	22.33	-17.6 **
Non-Teaching Hospitals	23.26	19.68	19.28	-17.1 **
Knee Replacement				
Academic Medical Centers	21.64	18.92	17.47	-19.3 **
Other COTH Hospitals	24.82	21.26	21.80	-12.2 **
Other Teaching Hospitals	26.96	25.38	24.40	-9.5
Non-Teaching Hospitals	21.60	20.47	19.90	-7.9
Total High-Tech Surgeries				
Academic Medical Centers	357.75	317.94	285.57	-20.2 **
Other COTH Hospitals	283.73	248.56	228.98	-19.3 **
Other Teaching Hospitals	212.97	197.89	179.50	-15.7 **
Non-Teaching Hospitals	119.12	111.52	100.07	-16.0 **

TABLE 3-10 (continued)

CHANGES IN ALLOWED CHARGES AND RVUs FOR HIGH-TECH SURGERY BY SELECTED SURGICAL PROCEDURE

RVUs/Admission	1991	1992	1993	Percent Change
CABG Surgery				
Academic Medical Centers	2.21	2.30	2.14	-3.3 %
Other COTH Hospitals	2.02	2.07	1.96	-3.1
Other Teaching Hospitals	1.44	1.53	1.44	0.1
Non-Teaching Hospitals	0.48	0.54	0.50	3.1
PTCA				
Academic Medical Centers	0.71	0.81	0.73	3.0
Other COTH Hospitals	0.76	0.84	0.76	-1.0
Other Teaching Hospitals	0.54	0.61	0.55	1.0
Non-Teaching Hospitals	0.24	0.28	0.23	-4.1
Hip Replacement				
Academic Medical Centers	0.62	0.60	0.57	-7.9 **
Other COTH Hospitals	0.64	0.60	0.58	-8.1 *
Other Teaching Hospitals	0.72	0.70	0.68	-5.4
Non-Teaching Hospitals	0.62	0.61	0.59	-5.6
Knee Replacement				
Academic Medical Centers	0.51	0.51	0.48	-7.1 **
Other COTH Hospitals	0.58	0.57	0.59	1.3
Other Teaching Hospitals	0.70	0.74	0.71	2.1
Non-Teaching Hospitals	0.56	0.60	0.58	4.6
Total High-Tech Surgeries				
Academic Medical Centers	8.18	8.55	7.91	-3.2 **
Other COTH Hospitals	6.32	6.46	6.14	-2.8
Other Teaching Hospitals	5.16	5.54	5.17	0.1
Non-Teaching Hospitals	2.96	3.19	2.92	-1.4

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-11

CHANGES IN REVENUES, RVUs, AND PRICES PER ADMISSION FOR GENERAL SURGERY: 1991 - 1993

	1991	1992	1993	Percent Change
Allowed Charges/Admission				
Academic Medical Centers	$391.09	$352.87	$324.03	-17.1 **
Other COTH Hospitals	354.08	306.39	284.55	-19.6 **
Other Teaching Hospitals	300.57	264.27	240.10	-20.1 **
Non-Teaching Hospitals	252.58	213.29	195.01	-22.8 **
RVUs/Admission				
Academic Medical Centers	9.47	10.26	9.71	2.5 **
Other COTH Hospitals	8.44	8.58	8.22	-2.6 **
Other Teaching Hospitals	7.78	8.06	7.46	-4.2 **
Non-Teaching Hospitals	6.76	6.66	6.20	-8.2 **
Price Per Service Index				
Academic Medical Centers	1.00	0.83	0.84	-16.0 **
Other COTH Hospitals	1.00	0.85	0.86	-13.7 **
Other Teaching Hospitals	1.00	0.85	0.86	-14.0 **
Non-Teaching Hospitals	1.00	0.84	0.86	-14.2 ***
Average Price Per RVU				
Academic Medical Centers	$41.14	$34.59	$33.46	-18.7 **
Other COTH Hospitals	41.96	35.93	34.82	-17.0 **
Other Teaching Hospitals	38.79	33.12	32.42	-16.4 **
Non-Teaching Hospitals	36.94	31.73	31.25	-15.4 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-12

DECOMPOSITION OF CHANGE IN REVENUES PER ADMISSION FOR GENERAL SURGERY INTO PRICE AND QUANTITY CHANGES: 1991-1993

	Revenues Per Admission (1)	Price Per Service (2)	Price Per RVU (3)	Services Per RVU* (4)	RVUs Per Admission (5)
Academic Medical Centers	-17.1%	-16.0%	-18.7%	-2.7%	2.5%
Other COTH Hospitals	-19.6	-13.7	-17.0	-3.3	-2.6
Other Teaching Hospitals	-20.1	-14.0	-16.4	-2.4	-4.2
Non-Teaching Hospitals	-22.8	-14.2	-15.4	-1.2	-8.2

* Based on simple subtraction of column (2) from column (3).

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

Table 3-13 offers considerable insight to these changes for general surgery, where we present trends for six common procedures: cholecystectomy, TURP, carotid endarterectomy, partial colectomy, colonoscopy, and upper GI endoscopy. With one exception (carotid endarterectomy), RVUs fell for all of the individual procedures shown. The reduction was particularly dramatic for TURPs whose RVUs were one-third lower in 1993 than in 1991. Since TURPs represent a relatively larger share of the general surgery volume in non-teaching hospitals, this may explain their relatively larger declines in overall general surgery RVUs.

There are three possible explanations for the reduction in TURPs. First, urologists may have responded to lower fees by cutting back on their performance of these procedures. Although possible, we consider this response unlikely; analysis of the OBRA-87 overpriced procedure reductions found no fee effect on TURP utilization (Mitchell and Cromwell, 1995). Second, our data capture inpatient use only, and more TURPs may have been moved to outpatient settings. Third, this decline may represent the continuation of a longer-term trend toward decreasing TURP utilization, as urologists and their patients increasingly opt for other treatments (either drugs or watchful waiting).

A shift to outpatient settings probably explains the volume declines for the two endoscopic procedures. The reasons behind declining intensity of cholecystectomy and partial colectomy are less clear, but it should be noted that the absolute magnitude of the reductions were relatively small (0.1-0.4 RVUs per admission). There were no major coding changes for these two procedures over the study period. Furthermore, while there may have been some substitution of laparoscopic cholecystectomy for the traditional open procedure, the RVUs for the two variants of this procedure are comparable. Also, during this time period, the vast majority of laparoscopic cholecystectomies (and all performed on Medicare patients) were performed during an inpatient hospital stay.

3.7 Changes in Revenues, RVUs, and Prices for High-Tech Tests

The overall decline in hospital-wide service intensity from 1991 to 1993 would appear to be explained largely by the dramatic reduction in high-tech tests (Table 3-14). RVUs per admission for these diagnostic tests fell by 50 percent or more in just three years. Physicians in academic medical centers performed (and billed for) 4.3 fewer RVUs' worth of such tests in 1993 than in 1991, an amount almost equal to their net total decline in RVUs (4.9). The

TABLE 3-13

CHANGES IN ALLOWED CHARGES AND RVUs FOR GENERAL SURGERY BY SELECTED SURGICAL PROCEDURE

Allowed Charges/Admission	1991	1992	1993	Percent Change
Cholecystectomy				
Academic Medical Centers	7.17	5.39	5.22	-27.2 %**
Other COTH Hospitals	10.76	8.01	7.65	-28.9 **
Other Teaching Hospitals	11.06	8.75	7.86	-28.9 **
Non-Teaching Hospitals	13.28	10.50	9.77	-26.5 **
TURP				
Academic Medical Centers	10.33	6.93	5.63	-45.5 **
Other COTH Hospitals	17.85	12.57	10.69	-40.1 **
Other Teaching Hospitals	18.34	13.59	10.86	-40.8 **
Non-Teaching Hospitals	20.18	14.98	12.39	-38.6 **
Carotid Endarterectomy				
Academic Medical Centers	7.93	7.99	7.28	-8.3 **
Other COTH Hospitals	7.84	7.03	6.85	-12.7 **
Other Teaching Hospitals	8.88	8.10	7.74	-12.8 **
Non-Teaching Hospitals	6.36	5.50	5.48	-14.0 *
Partial Colectomy				
Academic Medical Centers	10.70	8.33	8.14	-23.9 **
Other COTH Hospitals	13.41	10.56	10.03	-25.2 **
Other Teaching Hospitals	11.63	9.86	9.22	-20.7 **
Non-Teaching Hospitals	11.84	9.57	9.07	-23.3 **
Colonoscopy				
Academic Medical Centers	8.14	6.59	5.59	-31.4 **
Other COTH Hospitals	11.01	9.10	8.11	-26.3 **
Other Teaching Hospitals	10.40	8.82	7.85	-24.5 **
Non-Teaching Hospitals	9.63	7.88	7.45	-22.7 **
Upper GI Endoscopy				
Academic Medical Centers	15.32	13.09	11.94	-22.1 **
Other COTH Hospitals	19.41	16.31	15.10	-22.2 **
Other Teaching Hospitals	18.74	16.33	14.52	-22.5 **
Non-Teaching Hospitals	16.74	14.32	13.02	-22.2 **
All General Surgery				
Academic Medical Centers	391.09	352.87	324.03	-17.1 **
Other COTH Hospitals	354.08	306.39	284.55	-19.6 **
Other Teaching Hospitals	300.57	264.27	240.10	-20.1 **
Non-Teaching Hospitals	252.58	213.29	195.01	-22.8 **

TABLE 3-13 (continued)

CHANGES IN ALLOWED CHARGES AND RVUs FOR GENERAL SURGERY BY SELECTED SURGICAL PROCEDURE

RVUs/Admission	1991	1992	1993	Percent Change
Cholecystectomy				
Academic Medical Centers	0.19	0.19	0.17	-11.8 %**
Other COTH Hospitals	0.27	0.26	0.23	-15.1 **
Other Teaching Hospitals	0.31	0.31	0.26	-15.3 **
Non-Teaching Hospitals	0.38	0.38	0.33	-13.6 **
TURP				
Academic Medical Centers	0.25	0.21	0.16	-35.3 **
Other COTH Hospitals	0.43	0.37	0.31	-29.1 **
Other Teaching Hospitals	0.47	0.42	0.33	-30.3 **
Non-Teaching Hospitals	0.53	0.47	0.38	-27.9 **
Carotid Endarterectomy				
Academic Medical Centers	0.20	0.23	0.21	7.4 **
Other COTH Hospitals	0.20	0.21	0.20	3.7
Other Teaching Hospitals	0.23	0.25	0.24	2.3
Non-Teaching Hospitals	0.16	0.17	0.17	2.3
Partial Colectomy				
Academic Medical Centers	0.27	0.26	0.25	-10.2 **
Other COTH Hospitals	0.34	0.32	0.30	-12.2 **
Other Teaching Hospitals	0.32	0.33	0.29	-8.8 **
Non-Teaching Hospitals	0.34	0.32	0.30	-12.2 **
Colonoscopy				
Academic Medical Centers	0.19	0.18	0.16	-13.0 **
Other COTH Hospitals	0.25	0.25	0.23	-8.3 **
Other Teaching Hospitals	0.25	0.26	0.24	-5.4 *
Non-Teaching Hospitals	0.24	0.24	0.23	-3.4
Upper GI Endoscopy				
Academic Medical Centers	0.33	0.33	0.32	-2.6 *
Other COTH Hospitals	0.41	0.40	0.39	-4.5 **
Other Teaching Hospitals	0.42	0.42	0.40	-3.9 *
Non-Teaching Hospitals	0.38	0.38	0.37	-3.7
All General Surgery				
Academic Medical Centers	9.47	10.26	9.71	2.5 **
Other COTH Hospitals	8.44	8.58	8.22	-2.6 **
Other Teaching Hospitals	7.78	8.06	7.46	-4.2 **
Non-Teaching Hospitals	6.76	6.66	6.20	-8.2 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-14

CHANGES IN REVENUES, RVUs, AND PRICES PER ADMISSION FOR HIGH-TECH TESTS: 1991 - 1993

	1991	1992	1993	Percent Change
Allowed Charges/Admission				
Academic Medical Centers	$190.91	$164.47	$147.91	-22.5 **
Other COTH Hospitals	165.73	143.48	129.33	-22.0 **
Other Teaching Hospitals	141.99	122.73	108.56	-23.5 **
Non-Teaching Hospitals	93.60	81.24	72.47	-22.6 **
RVUs/Admission				
Academic Medical Centers	8.33	4.47	4.01	-51.9 **
Other COTH Hospitals	7.85	3.82	3.42	-56.4 **
Other Teaching Hospitals	6.61	3.30	2.99	-54.7 **
Non-Teaching Hospitals	3.87	2.08	1.95	-49.7 **
Price Per Service Index				
Academic Medical Centers	1.00	0.89	0.78	-21.8 **
Other COTH Hospitals	1.00	0.89	0.79	-21.3 **
Other Teaching Hospitals	1.00	0.90	0.80	-20.1 **
Non-Teaching Hospitals	1.00	0.89	0.81	-19.2 **
Average Price Per RVU				
Academic Medical Centers	$24.24	$37.67	$37.22	53.5 **
Other COTH Hospitals	22.90	38.73	38.34	67.4 **
Other Teaching Hospitals	23.38	37.91	36.70	57.0 **
Non-Teaching Hospitals	26.61	38.85	36.94	38.9 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

expected MFS reduction in price per service for these tests was only about 20 percent, which is close to the actual percent decline in revenues. The effective price per RVU actually *increased* over this time period, suggesting that physicians changed the mix of services they provided and/or billed for.

Table 3-15 illustrates the contribution of price and quantity changes to the overall change in revenues for high-tech tests. We see that the contributions of price per RVU and RVUs per admission to the declines in revenue are quite similar across the four hospitals groups (although somewhat smaller in absolute magnitude for non-teaching hospitals). Physicians, especially those in teaching hospitals, appear to have partially offset the MFS price reduction by providing (or billing) for more services per RVU. That is, physicians have altered their mix of high-tech tests, by substituting less RVU-intensive tests for more RVU-intensive ones.

We looked more closely at four commonly performed high-tech diagnostic tests: CT scan of the head, MRI scan of the brain, cardiac catheterization, and echocardiography. From Table 3-16, we can immediately see that cardiac catheterization drives the observed changes in revenues and RVUs for high-tech tests. Cardiac catheterization revenues per admission fell by one-quarter from 1991 to 1993, while its service intensity fell by over 70 percent. While cardiac catheterization RVUs declined in all types of hospitals, the absolute magnitude of the RVU decline was considerably higher for teaching hospitals. Academic medical centers and other COTH hospitals averaged over 3 RVUs fewer in 1993 than in 1991 *for this service alone.* (Total RVUs per admission for these hospitals averaged 41 and 36, in 1991 and 1993, respectively.)

What happened to cardiac catheterization? Examination of the individual Part A and Part B claims revealed two trends: (1) a true decline in the number of admissions involving cardiac catheterization; and (2) a change in the coding and billing of physician claims for cardiac cath procedures. We discuss each of these in detail below.

Although physician response to fee reductions under MFS is always a possibility, we suspect that many of these cardiac catheterization procedures have been shifted to the outpatient setting. In order to validate this hypothesis, we used the MedPAR claims for our sample of hospitals to examine trends in DRGs involving cardiac catheterization. These included DRG 104 (cardiac valve procedures with cardiac cath), DRG 106 (CABG surgery with cardiac cath), DRG 124 (cardiac cath with complex diagnosis), and DRG 125 (cardiac cath without complex diagnosis). These four DRGs include virtually all inpatient cardiac cath

TABLE 3-15

DECOMPOSITION OF CHANGE IN REVENUES PER ADMISSION FOR HIGH-TECH TESTS INTO PRICE AND QUANTITY CHANGES: 1991-1993

	Revenues Per Admission (1)	Price Per Service (2)	Price Per RVU (3)	Services Per RVU* (4)	RVUs Per Admission (5)
Academic Medical Centers	-22.5%	-21.8%	53.5%	75.3%	-51.9%
Other COTH Hospitals	-22.0	-21.3	67.4	88.7	-56.4
Other Teaching Hospitals	-23.5	-20.1	57.0	77.1	-54.7
Non-Teaching Hospitals	-22.6	-19.2	38.9	58.1	-49.7

* Based on simple subtraction of column (2) from column (3).

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-16

CHANGES IN ALLOWED CHARGES AND RVUs FOR HIGH-TECH TESTS
BY SELECTED DIAGNOSTIC PROCEDURE

Allowed Charges/Admission	1991	1992	1993	Percent Change
CT Scan Head				
Academic Medical Centers	7.50	6.58	6.24	-16.8 %**
Other COTH Hospitals	7.56	6.94	6.52	-13.7 **
Other Teaching Hospitals	7.30	6.96	6.41	-12.2 **
Non-Teaching Hospitals	7.27	6.42	6.00	-17.4 **
MRI Scan Brain				
Academic Medical Centers	2.36	2.49	2.62	11.2 **
Other COTH Hospitals	1.49	1.75	1.86	24.9 **
Other Teaching Hospitals	1.31	1.37	1.39	5.6
Non-Teaching Hospitals	1.19	1.24	1.34	12.2
Cardiac Catheterization				
Academic Medical Centers	64.17	59.84	48.40	-24.6 **
Other COTH Hospitals	61.07	55.88	44.42	-27.3 **
Other Teaching Hospitals	46.54	42.91	34.33	-26.2 **
Non-Teaching Hospitals	23.82	23.34	17.67	-25.8 **
Echocardiography				
Academic Medical Centers	28.15	25.69	27.95	-0.7
Other COTH Hospitals	25.07	24.24	26.87	7.2 **
Other Teaching Hospitals	26.02	25.35	25.14	-3.4
Non-Teaching Hospitals	19.88	19.68	19.88	0.0
Total High-Tech Tests				
Academic Medical Centers	190.91	164.47	147.91	-22.5 **
Other COTH Hospitals	165.73	143.48	129.33	-22.0 **
Other Teaching Hospitals	141.99	122.73	108.56	-23.5 **
Non-Teaching Hospitals	93.60	81.24	72.47	-22.6 **

TABLE 3-16 (continued)

CHANGES IN ALLOWED CHARGES AND RVUs FOR HIGH-TECH TESTS
BY SELECTED DIAGNOSTIC PROCEDURE

RVUs/Admission	1991	1992	1993	Percent Change
CT Scan Head				
Academic Medical Centers	0.18	0.18	0.17	-1.1 %
Other COTH Hospitals	0.17	0.18	0.17	0.7
Other Teaching Hospitals	0.18	0.19	0.18	2.5
Non-Teaching Hospitals	0.18	0.17	0.17	-3.7
MRI Scan Brain				
Academic Medical Centers	0.06	0.07	0.08	38.8 **
Other COTH Hospitals	0.03	0.05	0.05	49.8 **
Other Teaching Hospitals	0.03	0.04	0.04	26.9 **
Non-Teaching Hospitals	0.03	0.03	0.04	33.3 **
Cardiac Catheterization				
Academic Medical Centers	4.22	1.54	1.21	-71.4 **
Other COTH Hospitals	4.32	1.53	1.15	-73.4 **
Other Teaching Hospitals	3.31	1.15	0.92	-72.3 **
Non-Teaching Hospitals	1.62	0.56	0.44	-73.0 **
Echocardiography				
Academic Medical Centers	0.68	0.60	0.69	1.4
Other COTH Hospitals	0.61	0.51	0.62	1.4
Other Teaching Hospitals	0.66	0.53	0.59	-11.2 **
Non-Teaching Hospitals	0.48	0.42	0.46	-3.0
Total High-Tech Tests				
Academic Medical Centers	8.33	4.47	4.01	-51.9 **
Other COTH Hospitals	7.85	3.82	3.42	-56.4 **
Other Teaching Hospitals	6.61	3.30	2.99	-54.7 **
Non-Teaching Hospitals	3.87	2.08	1.95	-49.7 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

procedures except for those performed on medically treated AMIs (which we could not easily identify). The number of discharges from DRGs 104, 106, and 124 remained constant or increased slightly from 1991 to 1993, but the number of discharges in DRG 125 fell by about 30 percent. Since patients in DRG 125 presumably are considerably healthier than those in other cardiac cath DRGs, it seems reasonable to assume that physicians increasingly are catheterizing these patients on an outpatient basis.

The reduction in cardiac catheterization RVUs was far greater than can be explained solely by a shift of uncomplicated cases to the outpatient setting. In addition, there appears to have been a major change in how physicians in both teaching and non-teaching hospitals billed for inpatient cardiac catheterization procedures. In 1991, physicians attached the modifier "26" (indicating interpretation and report only) to their cardiac catheterization claims in only a small number of cases. Beginning in 1992, this modifier was used in virtually all cases. Presumably, the Medicare carriers issued instructions regarding the appropriate use of these modifiers. (There were no changes in the CPT manual for these codes over this time period.) The RVUs associated with modifier 26 are only about one-quarter the size of those associated with the unmodified cardiac cath codes. Thus, a large share of the RVU declines for cardiac catheterization would appear attributable to the substitution of less-RVU intensive variants of this procedure on cardiac cath claims.

3.8 Changes in Revenues, RVUs, and Prices for Routine Tests

Both price and quantity reductions appear to have contributed to the declines in revenues per admission for routine tests from 1991 to 1993, (Table 3-17). It should be noted that these tests represent a relatively small share of total inpatient revenues, however. Again, the average price per RVU fell relatively less than suggested by the price per service index, suggesting that physicians altered their mix of procedures. We see this more clearly in Table 3-18. Physicians, particularly those in other teaching and non-teaching hospitals, provided (and/or billed for) a less complex mix of routine tests over time.

Table 3-19 presents trends for four routine diagnostic tests: chest x-ray, hip x-ray, barium enema, and non-invasive cerebrovascular studies (e.g., Doppler and duplex scans). Revenues per admission fell for all four tests, with reduced revenues for chest x-ray accounting

TABLE 3-17

CHANGES IN REVENUES, RVUs, AND PRICES PER ADMISSION FOR ROUTINE TESTS: 1991 - 1993

	1991	1992	1993	Percent Change
Allowed Charges/Admission				
Academic Medical Centers	$65.01	$57.76	$50.20	-22.8 **
Other COTH Hospitals	58.16	51.31	47.17	-16.0 **
Other Teaching Hospitals	50.38	46.77	41.69	-17.2 **
Non-Teaching Hospitals	46.48	41.79	36.01	-22.5 **
RVUs/Admission				
Academic Medical Centers	1.41	1.36	1.23	-12.8 **
Other COTH Hospitals	1.26	1.17	1.10	-12.7 **
Other Teaching Hospitals	1.20	1.11	1.02	-15.0 **
Non-Teaching Hospitals	1.09	1.01	0.95	-12.8 **
Price Per Service Index				
Academic Medical Centers	1.00	0.84	0.81	-18.7 **
Other COTH Hospitals	1.00	0.85	0.83	-16.5 **
Other Teaching Hospitals	1.00	0.83	0.80	-19.5 **
Non-Teaching Hospitals	1.00	0.81	0.80	-19.9 **
Average Price Per RVU				
Academic Medical Centers	$48.12	$43.25	$41.46	-13.8 **
Other COTH Hospitals	46.71	44.17	43.22	-7.5 **
Other Teaching Hospitals	43.42	42.35	40.72	-6.2 **
Non-Teaching Hospitals	43.95	41.39	39.68	-9.7 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-18

DECOMPOSITION OF CHANGE IN REVENUES PER ADMISSION FOR ROUTINE TESTS INTO PRICE AND QUANTITY CHANGES: 1991-1993

	Revenues Per Admission (1)	Price Per Service (2)	Price Per RVU (3)	Services Per RVU* (4)	RVUs Per Admission (5)
Academic Medical Centers	-22.8%	-18.7%	-13.8%	4.9%	-12.8%
Other COTH Hospitals	-16.0	-16.5	-7.5	9.0	-12.7
Other Teaching Hospitals	-17.2	-19.5	-6.2	13.3	-15.0
Non-Teaching Hospitals	-22.5	-19.9	-9.7	10.2	-12.8

* Based on simple subtraction of column (2) from column (3).

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

TABLE 3-19

CHANGES IN ALLOWED CHARGES AND RVUs FOR ROUTINE TESTS BY SELECTED DIAGNOSTIC TEST

Allowed Charges/Admission	1991	1992	1993	Percent Change
Chest X-Ray				
Academic Medical Centers	25.79	24.19	21.56	-16.4 %**
Other COTH Hospitals	21.55	21.10	19.49	-9.6 **
Other Teaching Hospitals	18.27	17.99	16.27	-11.0 **
Non-Teaching Hospitals	17.34	16.07	14.55	-16.1 **
Hip X-Ray				
Academic Medical Centers	0.69	0.60	0.55	-20.1 **
Other COTH Hospitals	0.82	0.71	0.69	-16.0 **
Other Teaching Hospitals	0.77	0.73	0.69	-11.4 **
Non-Teaching Hospitals	0.82	0.72	0.68	-16.3 **
Barium Enema				
Academic Medical Centers	0.60	0.48	0.36	-39.4 **
Other COTH Hospitals	0.95	0.82	0.62	-34.8 **
Other Teaching Hospitals	1.02	0.86	0.65	-36.5 **
Non-Teaching Hospitals	1.36	1.09	0.85	-36.9 **
Non-Invasive Cerebrovascular Disease Studies				
Academic Medical Centers	3.59	2.63	2.25	-37.4 **
Other COTH Hospitals	4.58	3.24	2.83	-38.2 **
Other Teaching Hospitals	4.78	3.39	3.01	-37.0 **
Non-Teaching Hospitals	4.14	2.77	2.60	-37.3 **
Total Routine Tests				
Academic Medical Centers	65.01	57.76	50.20	-22.8 **
Other COTH Hospitals	56.16	51.31	47.17	-16.0 **
Other Teaching Hospitals	50.38	46.77	41.69	-17.2 **
Non-Teaching Hospitals	46.48	41.79	36.01	-22.5 **

TABLE 3-19 (continued)

CHANGES IN ALLOWED CHARGES AND RVUs FOR ROUTINE TESTS BY SELECTED DIAGNOSTIC TEST

RVUs/Admission	1991	1992	1993	Percent Change
Chest X-Ray				
Academic Medical Centers	0.56	0.60	0.56	0.9 %
Other COTH Hospitals	0.46	0.50	0.49	7.5 **
Other Teaching Hospitals	0.41	0.45	0.43	4.5 **
Non-Teaching Hospitals	0.39	0.41	0.39	-0.5
Hip X-Ray				
Academic Medical Centers	0.02	0.02	0.01	-5.0 **
Other COTH Hospitals	0.02	0.02	0.02	0.0
Other Teaching Hospitals	0.02	0.02	0.02	3.0
Non-Teaching Hospitals	0.02	0.02	0.02	-2.5
Barium Enema				
Academic Medical Centers	0.01	0.01	0.01	-27.8 **
Other COTH Hospitals	0.02	0.02	0.02	-25.0 **
Other Teaching Hospitals	0.02	0.02	0.02	-26.6 **
Non-Teaching Hospitals	0.03	0.03	0.02	-28.4 **
Non-Invasive Cerebrovascular Disease Studies				
Academic Medical Centers	0.24	0.06	0.05	-80.4 **
Other COTH Hospitals	0.27	0.06	0.05	-82.3 **
Other Teaching Hospitals	0.30	0.07	0.06	-80.6 **
Non-Teaching Hospitals	0.25	0.06	0.05	-79.2 **
Total Routine Tests				
Academic Medical Centers	1.41	1.36	1.23	-12.8 **
Other COTH Hospitals	1.26	1.17	1.10	-12.7 **
Other Teaching Hospitals	1.20	1.11	1.02	-15.0 **
Non-Teaching Hospitals	1.09	1.01	0.95	-12.8 **

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

for about one-third of the total decline in routine test revenues. Of the tests shown, the cerebrovascular studies appear to be largely responsible for the decline in routine test RVUs. Most likely, these tests are being performed more often in outpatient settings.

3.9 Trends in Assignment and Participation Rates

Besides altering payment levels, the MFS also put a cap on the amount non-participating physicians could balance bill. In 1992, non-participating physicians were limited to 120 percent of their recognized payment amounts. This was lowered to 115 percent in 1993 and thereafter. To the extent that teaching physicians were less likely to have signed participation agreements, they would have experienced relatively large losses in total (Medicare plus patient) revenues. In fact, as seen in Table 3-20, physicians in major teaching facilities (academic medical centers and other COTH hospitals) were somewhat more likely to accept assignment and significantly more likely to have signed participation agreements. Assignment and participation rates increased significantly from 1991 to 1993 for physicians practicing in both teaching and non-teaching hospitals.

TABLE 3-20

CHANGES IN ASSIGNMENT AND PARTICIPATION RATES (percent of allowed charges): 1991 - 1993

	1991	1992	1993	Percent Change
Assignment Rate				
Academic Medical Centers	90.3 %	93.9 %[b]	95.6 %	5.9 %**
Other COTH Hospitals	88.9	91.6	95.1	7.0 **
Other Teaching Hospitals	85.7	88.5	93.5	9.0 **
Non-Teaching Hospitals	85.6	88.5	93.5	9.3 **
Participation Rate				
Academic Medical Centers	75.1 [a]	84.5 [a]	88.8 [a]	18.2 **
Other COTH Hospitals	71.1 [a]	79.3 [a]	86.1 [a]	21.1 **
Other Teaching Hospitals	65.0	73.9	83.4	28.2 **
Non-Teaching Hospitals	63.3	72.0	81.3	28.4 **

[a] Significantly different from non-teaching hospitals at the 0.01 level.

[b] Significantly different from non-teaching hospitals at the 0.05 level.

** Percent change significant at the 0.01 level.

* Percent change significant at the 0.05 level.

SOURCE: Medicare Part A and Part B claims for a sample of hospitals, 1991-1993.

REFERENCES

Anderson GF, *et al*: *Providing Hospital Services: The Changing Hospital Environment.* Baltimore: The Johns Hopkins University Press, 1989.

Burge RT, JB Mitchell and LW Katz: *Case Study of Teaching Hospitals.* Final Report submitted to the Health Care Financing Administration under Cooperative Agreement No. 17-C-90015, 1994.

Lee PR, *et al.*: "The Physician Payment Review Commission Report to Congress". *JAMA* 261: 2382-2385, 1989.

Levy JM: "Impact of the Medicare Fee Schedule on Payments to Physicians". *JAMA* 264: 717-722, 1991.

McGuire TG and MV Pauly: "Physician Response to Fee Changes with Multiple Payors". *Journal of Health Economics* 10: 385-410, 1991.

Miller ME and WP Welch: "Growth in Medicare Inpatient Physician Charges Per Admission: 1986-1989". *Inquiry* 30:249-259, 1993.

Mitchell JB: "Time Trends in Inpatient Physician Spending". *Health Services Research* 28:641-660, 1993.

Mitchell JB, RT Burge and DN McPartlin: *Teaching Physicians and the Medicare Program.* Final Report submitted to the Health Care Financing Administration under Cooperative Agreement No. 17-C-90015, 1995.

Mitchell JB and J Cromwell. "Impact of Medicare Payment Reductions on Access to Surgical Services". *Health Services Research* 30: 637-655, 1995.

Mitchell JB and RP Ellis: "Alternative Payment Systems for Hospital Medical Staffs". *Inquiry* 29:21-32, 1992.

Mitchell JB, NT McCall, RT Burge *et al.*: *Per Case Prospective Payment for Episodes of Hospital Care.* Final Report submitted to the Health Care Financing Administration under Contract No. 500-92-0020, 1995.

Welch WP: "Do All Teaching Hospitals Deserve an Add-On Payment under the Prospective Payment System?" *Inquiry* 24: 221-232, 1987.